SEPTEMBER 1960 VOL. VIII

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PLANT PROTECTION BULLETIN

A PUBLICATION OF THE WORLD REPORTING SERVICE ON PLANT DISEASES AND PESTS

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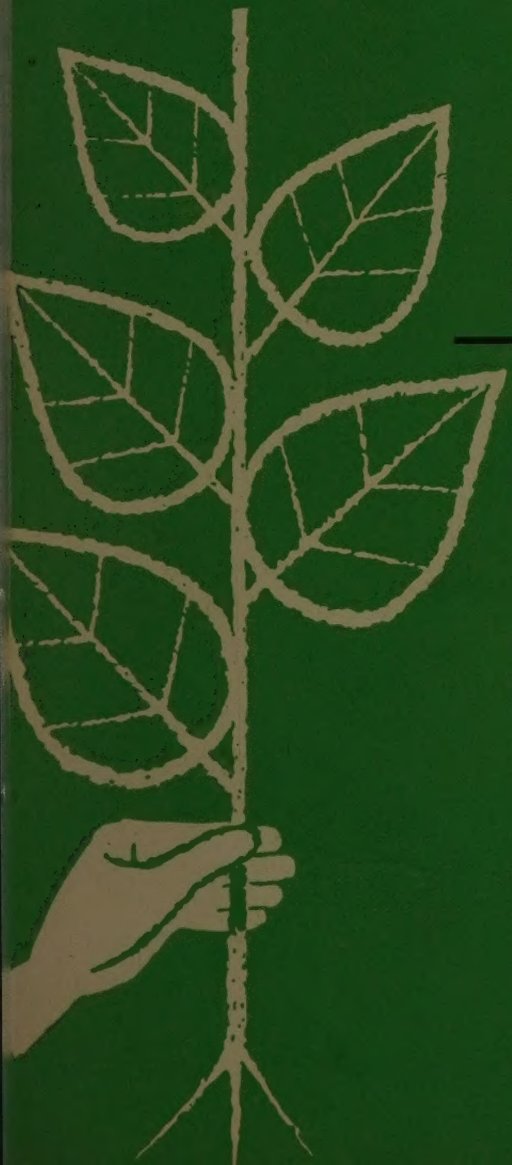

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is issued as a medium for the dissemination of information received by the World Reporting Service on Plant Diseases and Pests, established in accordance with the provisions of the International Plant Protection Convention, 1951. It publishes reports on the occurrence, outbreak and control of pests and diseases of plants and plant products of economic significance and related topics, with special reference to current information. No responsibility is assumed by FAO for opinions and viewpoints expressed in the Bulletin.

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Vol. VIII, No. 12 - SEPTEMBER 1960

FAO PLANT PROTECTION BULLETIN

A PUBLICATION OF THE WORLD REPORTING SERVICE ON PLANT DISEASES AND PESTS

Injuries in Citrus Attributed to Brevipalpus Mites, Including Brevipalpus Gall, a Newly Reported Disorder in Sour-Orange Seedlings[1]

L. C. Knorr, Citrus Experiment Station, University of Florida, Lake Alfred, Florida, U.S.A., *B. N. Webster*, Servicio Shell para el Agricultor, Cagua, Edo. Aragua, Venezuela, and *Gino Malaguti*,[2] Ministerio de Agricultura y Cria, Centro de Investigaciones Agronomicas, Maracay, Edo. Aragua, Venezuela

Brevipalpus mites appear doubly inscrutable, first because their diminuative size renders them invisible to the naked eye and second because their variable behavior on citrus makes them difficult to comprehend. This incomprehensibility rests to a certain extent, no doubt, on a late recognition of their importance as pests ; it was not until 1903 that Brevipalpus mites were discovered and identified in the United States, and not until 1949 that they were shown to be the cause of a serious disease of citrus in Florida. Incomprehensibility must also derive from the conflict in reports concerning the types of injury to citrus ; for example, the same species may be reported to cause an angry spotting of fruit in one area of the world, while no spotting at all in another area, despite the fact that in both places this species may be present in numbers sufficiently large to require spraying.

This paper brings together various reports that have been published on Brevipalpus injuries to citrus, and describes another type of symptom associated with large populations of Brevipalpus mites, viz., Brevipalpus gall.

[1] Florida Agricultural Experiment Stations Journal Series no. 1111.

[2] The writers wish to thank the Fundación Creole of Caracas, Venezuela, for the arrangements that permitted the interchange of personnel from the various institutions represented.

Review

Brevipalpus obovatus Donnadieu (syn.[3] *Brevipalpus pereger* Donn., *B. inornatus* Baker, *B. bioculatus* Reck, *Tenuipalpus inornatus* Banks, *T. bioculatus* McGregor, *T. pseudocuneatus* Blanchard) was reported by Frezzi (8) to produce, in leaves of sweet orange and sour orange, large chlorotic spots with concentric rings of a chestnut-colored resinous substance (Figure 1). Such spots attain sufficient size at times to cover one third the surface of a leaf. Somewhat similar but smaller spots are produced on fruits (Figure 2). Ringspots are formed also on twigs ; in later stages, these spots erupt to produce scaling of bark that resembles the shelling caused by scaly-bark psorosis. The foregoing manifestations of *B. obovatus* are those of a disease known in South America as lepra explosiva. The cause-and-effect relationship between mites and lepra explosiva has been amply demonstrated by Vergani (18).

Brevipalpus californicus (Banks) (syn. *Brevipalpus californicus* McGregor, *B. australis* Baker, *B. woglumi* McGregor, *B. confusus* Baker, *B. browningi* Baker, *Tenuipalpus californicus* Banks, *T. australis* Tucker, *T. vitis* Wormersley, *T. obovatus* Sayed) produces small platelets of dry gummy material on leaves and

[3] Synonymy is in accordance with the taxonomy of Pritchard and Baker (16).

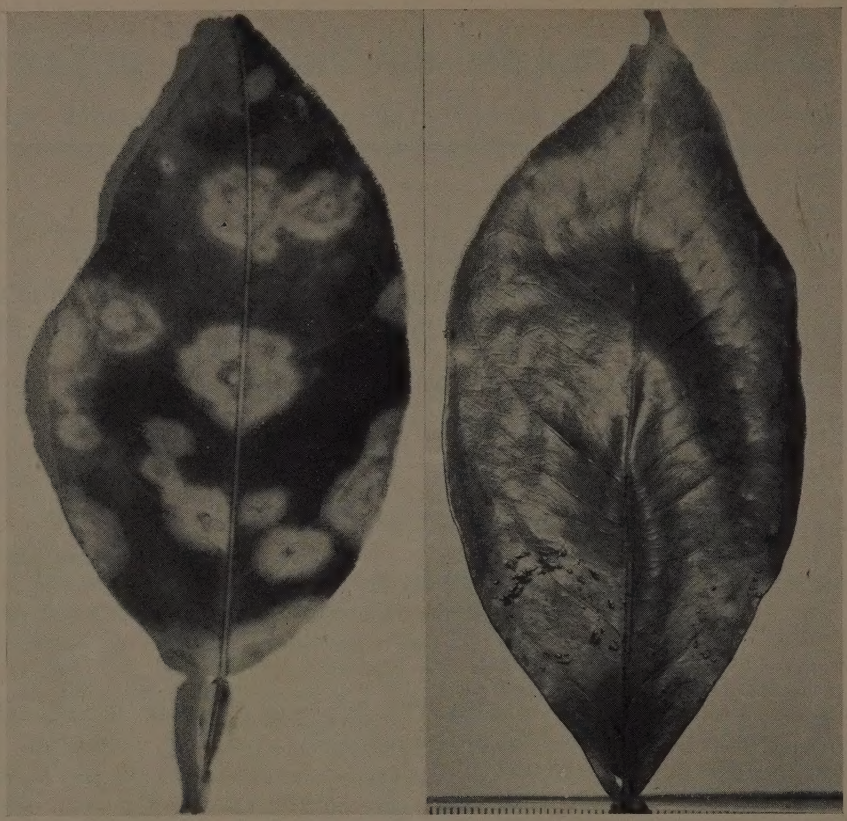

Figure 1. Chlorosis and ringspotting of sweet-orange leaves caused by *Brevipalpus obovatus*, the false spider mite responsible for lepra explosiva in South America. (Photograph at left courtesy of Facultad de Agronomia, Universidad Central de Venezuela; photograph at right courtesy of Dr. E. P. DuCharme, Florida Citrus Experiment Station.)

fruits of sweet orange (Figure 3). Similar platelets are formed on twigs, and in later stages, as affected twigs grow into large limbs, these lesions increase proportionately in size and resemble the scrofulous shelling of bark described above for lepra explosiva. In Florida, the disease caused by *B. californicus* in leaves and fruits has been called nailhead rust, and the disease on twigs and branches, Florida scaly bark. Today, in recognition of the newer knowledge that these two troubles are caused by the same agent, both diseases are called leprosis. This trouble was long thought to have been caused by a fungus, *Cladosporium herbarum* var. *citricolum*, but in 1949 leprosis was shown to be reproducible by placing *B. californicus* on caged seedings of sweet orange (9, 10).

Brevipalpus californicus has also been reported as a pest of citrus in California (5, 16) but, oddly enough, while this species may sometimes become so numerous as to require spraying, there is no development of symptoms even remotely suggestive of leprosis as it appears on fruits, leaves, and bark in Florida.[4] In

[4] In personal correspondence between L. C. Knorr and Drs. A. P. Pritchard and H. H. Keifer, respectively of the University of California and the California State Department of Agriculture.

Spain (14, 15) and in South Africa, injury attributed to the presence of *B. californicus* consists of a brown speckling of the rind in sweet-orange fruits (Figure 4); specks range from pinpoint to pinhead in size, and are restricted in depth to the thickness of the flavedo.[5] In New South Wales, *B. californicus* is described as causing a silvering of the fruit, particularly in lemons; from this effect the mite is known in Australia as the silver mite (2).

Brevipalpus lewisi McGregor has been mentioned from California as causing in lemons, oranges, grapefruits and tangerines a scab-like, brown-colored scarring of the fruit; affected areas resemble those resulting from sulfur burn, except that the injury due to mites is more corky in appearance and irregular in outline. This damage is thought to be caused secondarily by infestations that center around lesions initially produced through the feeding of leaf hoppers or the ovipositions of thrips. In milder stages, attacks are described as causing a light silvering of the rind. No injury has been observed on the leaves or twigs of infested trees (6).

Brevipalpus phoenicis (Geijskes) (syn. *Brevipalpus phoenicis* Sayed, *B. yothersi* Baker, *B. mcbridei* Baker, *B. papayensis* Baker, *B. pseudocuneatus* Baker, *Tenuipalpus phoenicis* Geijskes) has been shown in Florida (10) to be responsible for diffuse chlorotic spotting of citrus foliage (Figure 5), but only when mites are present in extraordinarily large numbers. Sweet-orange fruits may be russetted in the presence of heavy populations of these mites, but no causal relationship between russet and *B. phoenicis* has yet been proved. Twigs and limbs have not been found to show symptoms even under conditions of heavy infestations, as when leaf spotting occurs.

Brevipalpus phoenicis has also been reported to be involved in halo scab (Figure 6), a disorder in Venezuela that has been found to be destructive to sour-orange seedlings in the nursery. Halo scab results when these mites infest the scabs caused by *Elsinoe fawcetti* Bitanc. & Jenkins. While leaves attacked by

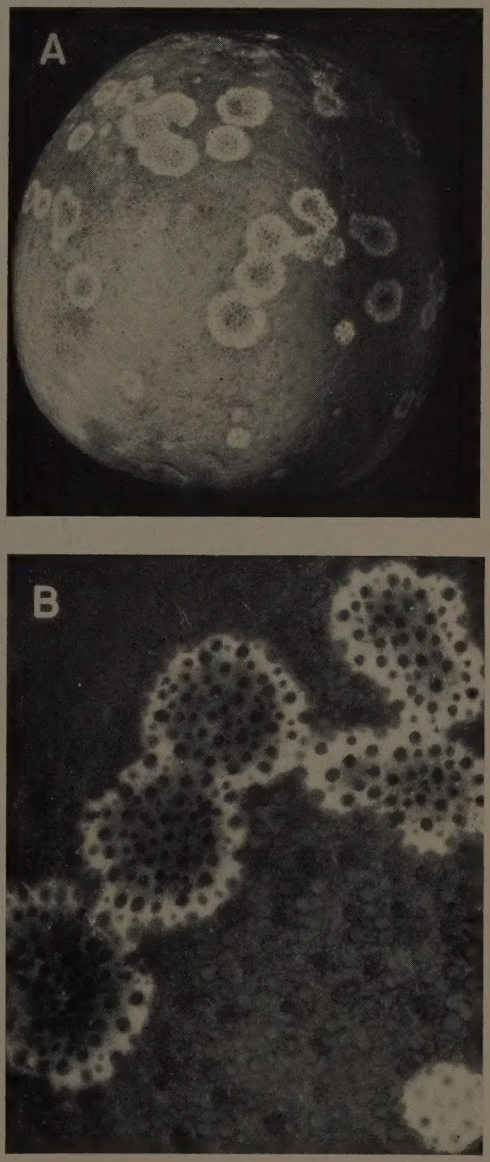

Figure 2. A. Spotting of sweet orange fruit by *Brevipalpus obovatus*. B. Enlargement of lesions. (Photographs courtesy of Facultad de Agronomia, Universidad Central de Venezuela.)

[5] Description is based on specimens sent to L. C. Knorr through the courtesy of Mr. M. B. Georgala, Entomologist, South African Co-operative Citrus Exchange, Ltd., Nelspruit.

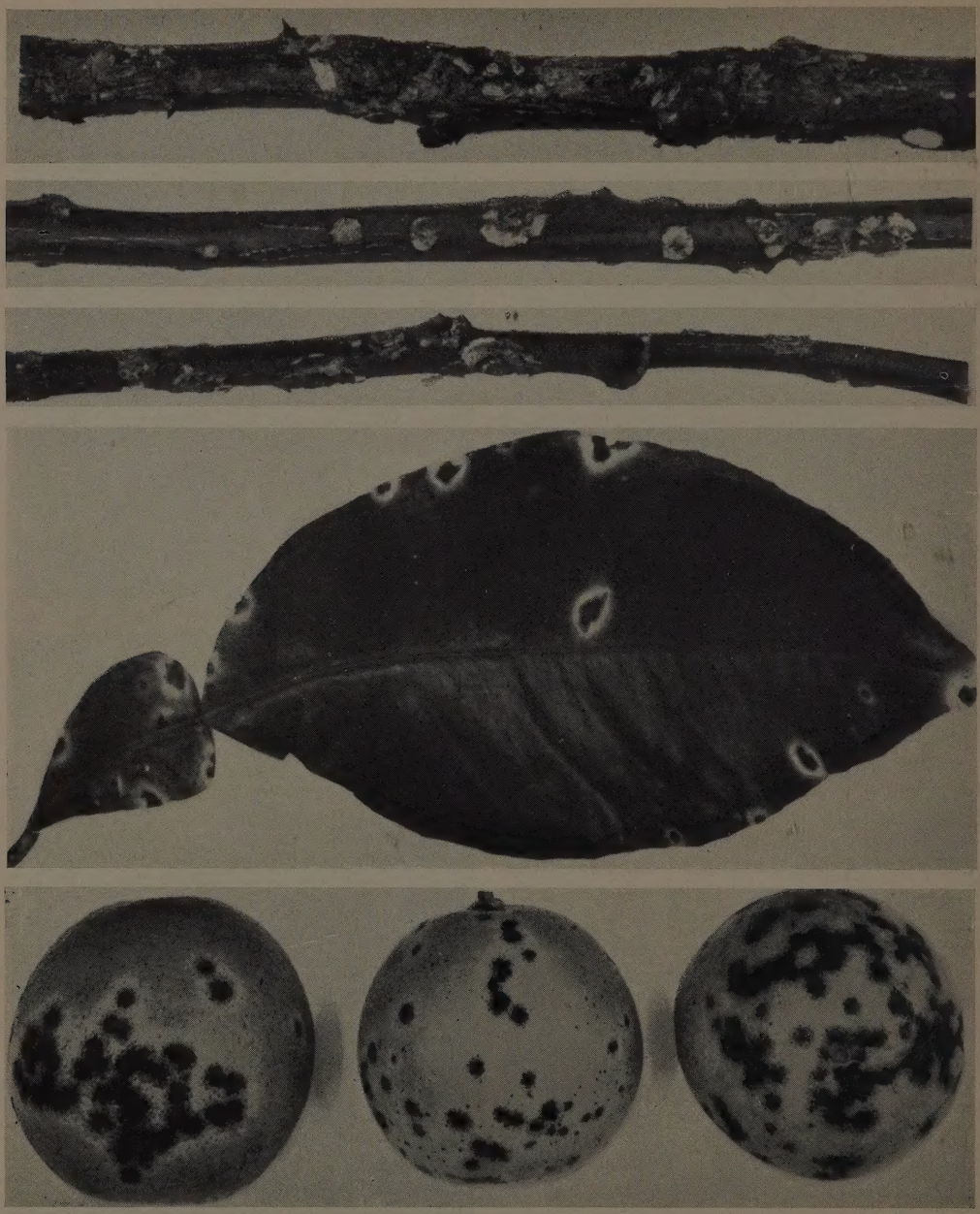

Figure 3. Lesions produced by *Brevipalpus californicus* in Florida on twigs, foliage, and fruit. When appearing on leaves and fruits, the disease has been called nailhead rust, and when on twigs, branches, and trunks, Florida scaly bark. Today, in recognition of the fact that both names refer to one and the same disease, the disorders are called leprosis.

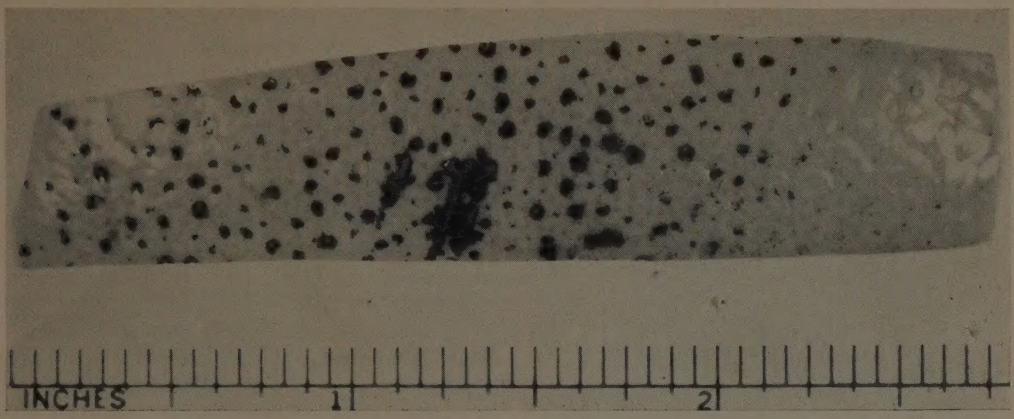

Figure 4. Speckling of the peel of sweet orange, a trouble in South Africa and Spain found in association with *Brevipalpus californicus*. (Photographed from a preserved specimen received through the courtesy of M. B. Georgala, Entomologist, South African Co-operative Citrus Exchange, Ltd., Nelspruit.)

Figure 5. Leaf symptoms of Brevipalpus injury from a grove in Florida with high populations of *Brevipalpus phoenicis*. These chlorotic spots resemble those produced on sweet-orange seedlings which were infested with *B. phoenicis* under experimental conditions. (Photograph courtesy of Mrs. Madge Collier, Citrus Experiment Station, Lake Alfred, Florida.)

the scab fungus alone do not shed, those attacked jointly by *E. fawcetti* and *B. phoenicis* fall readily and lead eventually to defoliation and death of affected plants. Implication here of *B. phoenicis* is by association only, though the leaf-spotting and leaf-dropping phases are similar to those produced under experimental conditions when sweet-orange seedlings are heavily infested with *B. phoenicis*.

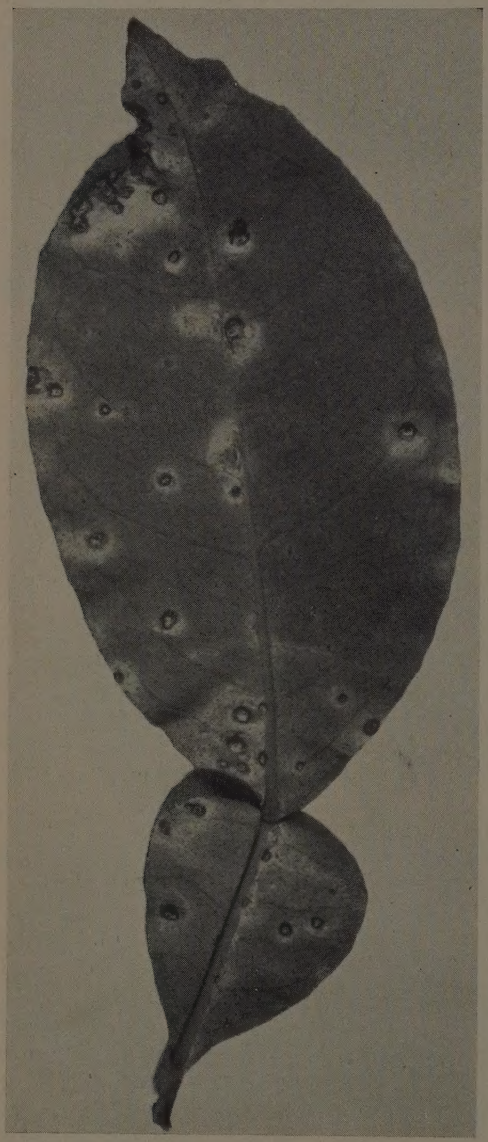

Figure 6. Halo scab, a disease in sour-orange foliage attributed to the combined attack of *Elsinoe fawcetti* and *Brevipalpus phoenicis*. (Photograph courtesy of Facultad de Agronomia, Universidad Central de Venezuela.)

Brevipalpus mcgregori Baker has been found infesting lemons in California, but extent of damage is slight, apparently, since no details are given (5).

Brevipalpus mites are also active elsewhere in the world, though reports do not always include information on species involved nor on type of damage to citrus. Brevipalpus mites of various species have been mentioned as causing economic damage to citrus in Senegal (1) and in Tunisia (13), and Ebeling (5) lists Brevipalpus mites as pests of citrus in other parts of the world not already mentioned: Cuba, Egypt and India. In addition, there are many countries listed by Fawcett (7) - China, Japan, the Philippines, Java, India, Ceylon, Egypt, South Africa, and various countries in South America - in which leprosis is said to occur, but in none of these cases has mention been made of the causal agent involved nor of the extent of damage.

Brevipalpus gall

Another disturbance in citrus, called Brevipalpus gall, is here described for the first time. The trouble was recently encountered in a citrus nursery near Guacara in Estado Carabobo, Venezuela, where 60 percent of the sour-orange seedlings were affected and in various stages of decline, ending with death of stricken plants. The same condition was subsequently seen at Maracay, Estado Aragua, in a nursery some 40 kilometers to the east of the original finding, where 15 percent of the sour-orange seedlings were affected.

Symptoms of Brevipalpus gall consist of proliferations along the main stems of seedlings (Figure 7). In size, galls range from protuberances that are barely visible to those 5 millimeters in diameter. Consistency of the galls is woody. External appearance is that of axils that have proliferated to the point where bud-

studded cushions are developed. No leaves are to be found at the axils occupied by these cushions ; the effect produced in a plant where each node bears a gall is that of complete defoliation. Such leafless plants eventually decline and die.

Gall formation is brought about, apparently, by the abscission of the initial leaves, a reaction known to occur under experimental conditions whenever large numbers of Brevipalpus mites are placed on citrus seedlings. The dropping of leaves prompts the sprouting of adventitious buds, and as these are fed upon and destroyed, other shoots are produced and in turn are again destroyed. The total effect is to produce hypertrophies at the bud loci.

When examined microscopically, these galls reveal the presence of great numbers of Brevipalpus mites. In contrast to the teeming activity of mites at the galls is the scarcity of mites along the lengths of stem between the nodes. In the Maracay nursery, Brevipalpus gall was in many cases found to occur on plants also attacked by halo scab.

Mites were collected from numerous randomly-selected galls and sent to Dr. Edward W. Baker, Smithsonian Institution, Washington, D.C., for identification. In all cases the mites proved to be *Brevipalpus phoenicis*.

It is, of course, improper to include on the basis of association alone that *Brevipalpus phoenicis* is the cause of Brevipalpus gall. It might, however, be permissible to entertain such a hypothesis because : (*a*) *B. phoenicis* was found in constant association with galls ; (*b*) populations of the mites at galls were exceedingly great ; (*c*) under controlled experiments, *B. phoenicis* causes similar chlorotic spotting and dropping of the leaves ; and (*d*) in plants other than citrus, *B. phoenicis* is known to produce galls.

It is possible that Brevipalpus mites are introduced into a nursery on infested budsticks. In the Maracay outbreak, a few sour-orange seedlings were found that apparently had been budded some time before Brevipalpus gall developed. These sweet-orange buds sprouted, grew normally, and attained a length of 1 meter. This amount of growth preceding defoliation and production of Brevipalpus galls in both stock and scion portions of the main stems indicates that destructive build-up of mites must have occurred some time after the initial budding.

Figure 7. Brevipalpus gall, a disease in sour-orange seedlings found associated with high populations of *Brevipalpus phoenicis*. (Photograph courtesy of Facultad de Agronomia, Universidad Central de Venezuela.)

Discussion

The versatility, virulence, and apparent chameleonic behavior of these nearly invisible mites, as reflected in various injuries to citrus,

provide interesting problems for further study. First, however, it is necessary to establish whether mites and damage actually bear a cause-and-effect relationship. Certain troubles attributed to Brevipalpus mites have already been experimentally studied, while other cases are linked to these mites merely because they happened to be found at the scene of destruction.

Another difficulty in ascribing causal relationships comes from the occurrence of mixed species on a single host. In citrus trees on the East Coast of Florida, it has been observed [6] after periodic sampling that *Brevipalpus phoenicis* and *B. californicus* may occupy the same leprotic lesions; and to make matters still more confusing, *B. phoenicis* may at times supersede *B. californicus*, with the result that the unwary observer, finding only *B. phoenicis*, may be led to the erroneous conclusion that *B. phoenicis* is the cause of leprosis.

A further difficulty in attributing responsibility for injury to a particular species results from differences of opinion among taxonomists as to what constitutes the species. Currently, one specialist sees specific differences between *Brevipalpus californicus* and *B. phoenicis*, whereas another reduces *B. phoenicis* to synonymy with *B. californicus*.

Once causal relationships have been correctly established, it will be possible to investigate such questions as to why *Brevipalpus californicus* does not cause leprosis in California, why *B. obovatus* does not cause lepra explosiva in Florida, and why *B. californicus* does not cause speckling of peel in countries other than Spain and South Africa.

Proper etiological studies will help also in determining whether mites function as vectors of some virus which cause lepra explosiva and leropsis or whether these mites incite morbidity in citrus by some toxic principal in their saliva. If the virus possibility proves to be the answer, then leprosis would appear wherever *Brevipalpus californicus* happens to be viruliferous. No evidence exists, however, from work done in Argentina (18) and in Florida [7] that a virus is involved in leprosis; transmission studies using buds from affected trees have consistently failed to transmit the disorder to healthy seedlings.

The proper employment of rules of proof should also make it possible to assess the validity of a curious suggestion made recently by Dippenaar (4) that ring blotch, lepra explosiva, and nailhead rust are all caused by an eriophyid mite.

Control measures may be vitiated by erroneous conclusions based merely on associationships. This is well illustrated by the misconception held for many years in Florida that the rust mite, *Phyllocoptruta oleivora* (Ashm.), by its association with greasy spot, was the cause of this disease. Great quantities of sulfur were applied in the control of these mites, but indifferent results were obtained in preventing the development of greasy spot. Only recently has it been discovered that greasy spot is not at all the product of an eriophyid mite but of a fungus, and that the fungus is best controlled by the application, not of sulfur, but of copper.

Fortunately, in the case of Brevipalpus mites, though their potentialities for destruction are great, there is little need for economic concern; control of these mites is simple, cheap, and immediate. Regardless of species involved, eradication can be obtained with a single spray of wettable sulfur, 5 to 10 pounds in 100 gallons of water (3, 11, 17).

[6] L. C. KNORR, unpublished data.

[7] L. C. KNORR, unpublished information.

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PLANT QUARANTINE ANNOUNCEMENTS

REPUBLIC OF SENEGAL

Decree No 60-121 of 10 March 1960, published in the *Journal Officiel de la République du Sénégal* on 26 March 1960, provides for the institution of phytosanitary control on the importation and exportation of plants and plant products. The main provisions concerning importation are as follows.

General regulations

Plants, parts of plants, seeds, soil, manure and compost destined for importation, together with their packing materials, must be accompanied by a phytosanitary certificate issued by the authority of the country of origin stating that they are free from parasites. This requirement does not apply to vegetable and fresh fruit for consumption unless specifically indicated.

Plant materials imported from the American tropics must be covered by an import permit obtained in advance from the Plant Protection Service and will be subject to inspection on arrival.

Plants or plant products, which may be imported only for scientific purpose, or by the Plant Protection Service, or under an import permit, must be introduced through the port of Dakar and the airport of Dakar-Yoff. Other materials may, in addition, be introduced through the ports of Koalack and Zinguinchor.

Specific requirements

When certain plants and plant products are specified below as "prohibited," such plants and plant products may not be imported, except by the Plant Protection Service in emergencies for scientific work. In such cases, pre-entry quarantine in a recognized station is required.

When an import permit is required, the permit must be issued in advance by the Plant Protection Service.

Acacia spp.

Vegetative material - prohibited.

Seed - import permit and certificate with additional declaration of growing season inspection.

Aleurites spp.

Vegetative material and seed from countries in Africa South of the Sahara - certificate.

Vegetative material and seed from other countries - import permit and certificate with declaration of growing season inspection.

Alfalfa or lucerne (*Medicago* spp.)

Vegetative material and fodder - prohibited.

Seed - certificate with declaration of growing season inspection concerning freedom from *Urophlyctis alfalfae*, alfalfa dwarf virus and *Cuscuta*.

Allium spp.

Vegetative material for consumption from areas where *Urocystis cepulae* occurs - prohibited; from areas where *U. cepulae* does not occur - certificate.

Vegetative material for planting - import permit and certificate with declaration that by growing season inspection plants and the field were found free from *U. cepulae*, or that *U. cepulae* does not occur in the country of origin.

Seed - certificate.

Avocado (*Persea* spp.)

Vegetative material - import permissible only by Plant Protection Service, and requiring certificate with declaration of growing season inspection concerning freedom from virus diseases.

Seed - unrestricted.

Banana and plantain (*Musa* spp.)

Vegetative material from countries where *Fusarium oxysporum* var. *cubense* or bunchy

top exists - prohibited; from countries where these diseases do not exist - import permissible only by Plant Protection Service and requiring certificate with declaration of growing season inspection concerning virus and other diseases.

Leaves for packing or other uses - prohibited.

Fresh fruit from countries where *Dacus dorsalis* exists - prohibited; from other countries - unrestricted.

Seed - import permit.

Bulbs, tubers, rhizomes and other subterranean organs for propagation of ornamental and other plants (excluding potatoes and sweet potatoes) - certificate with declaration of growing season inspection certifying, whenever possible, freedom from harmful nematodes and requiring freedom of the consignment from soil.

Cabbages (*Brassica* spp.)

Seed - certificate with declaration that by growing season inspection the seed-producing plants were found free from *Xanthomonas campestris* or that the seeds have been treated against this bacterial disease (with description of treatment).

Cacao (*Theobroma* spp.)

Vegetative material, whole fruit and seed from countries in Africa South of the Sahara - unrestricted.

Vegetative material from other countries - import permissible only by Plant Protection Service, and requiring certificate with declaration of growing season inspection. The material must also be quarantined first in the United States or Europe and again in Africa South of the Sahara.

Whole fruit from other countries - prohibited.

Seed from other countries - import permit, certificate with declaration of growing season inspection of parent trees, quarantine.

Cassava (*Manihot* spp.)

Vegetative material and seed from countries in Africa South of the Sahara - certificate, and for seed requiring import permit in addition.

Vegetative material and seed from other countries - import permissible only by Plant Protection Service, and requiring certificate with declaration of growing season inspection concerning diseases especially virus diseases. For vegetative material, quarantine is also required.

Products for consumption from any source - unrestricted.

Cereals (*Hordeum, Triticum, Avena, Secale*)

Vegetative material - prohibited.

Seed for planting - import permit and certificate with declaration that the seed has been treated before shipment with description of treatment.

Commercial shipments - inspection on arrival and treatment if necessary.

Chestnut (*Castanea vulgaris*)

Vegetative material and seed for planting from African countries South of the Sahara - certificate.

Vegetative material and seed for planting from other countries - import permit and certificate with declaration that by growing season inspection *Endothia parasitica* was not found in the region of origin.

Fruits for consumption - unrestricted.

Citrus and related species (Rutaceae)

Vegetative material with roots from Congo, Ivory Coast, Madagascar, Mascarene Island and Mauritius and all countries not situated in Africa South of the Sahara - prohibited; from countries in Africa South of the Sahara, except those mentioned above - import permissible only by Plant Protection Service, and requiring certificate with declaration that *Xanthomonas citri* does not exist in the country of origin and that the material has been fumigated before dispatch, with description of the treatment.

Vegetative material without roots from countries where *X. citri* occurs - prohibited; from countries where citrus canker does not occur - import permissible only by Plant Protection Service and requiring certificate with declaration that the ma-

terial is free from citrus canker, that citrus canker is unknown in the country of origin, and that the material has been fumigated, with description of the treatment.

Seed from any country - import permit and certificate with declaration that by growing season inspection parent trees were free from citrus canker and other diseases, and that the seed has been treated with hydrogen peroxide with description of treatment.

Fruit in commercial shipments from countries where *X. citri* does not exist - unrestricted but subject to inspection and treatment.

Clover (*Trifolium* spp.)

Vegetative material - prohibited.

Seed - certificate.

Fodder from countries in Africa South of the Sahara - certificate; from other countries - prohibited.

Coconut (*Cocos nucifera*), including dwarf coconut

Vegetative material and nuts (germinated and non-germinated) from North, South and Central America, West Indies, Seychelles, Madagascar and Mozambique - prohibited.

Vegetative material and germinated nuts from other countries - import permissible only by Plant Protection Service and requiring certificate with declaration of growing season inspection concerning all diseases and quarantine.

Nuts non-germinated from other countries - certificate.

Nuts for consumption - unrestricted.

Coffee (*Coffea* spp.)

Vegetative material and seed - imports permissible only by Plant Protection Service and requiring certificate with declaration of growing season inspection. For vegetative material, the declaration should indicate freedom from viruses and tracheomycosis; quarantine is also required. For seed from the New World the declaration should refer to the inspection of seed-producing trees concerning freedom from viruses and tracheomycosis. For seed from other countries, the declaration refers to the inspection of seed-producing trees.

Berries - prohibited.

Beans for consumption - inspection and if necessary treatment.

Conifers

Vegetative material and seed from countries in Africa South of the Sahara - certificate.

Vegetative material from other countries - prohibited.

Seed from other countries - certificate and subject to inspection and treatment on arrival.

Cotton (*Gossypium* spp.)

Vegetative material - prohibited.

Seed from countries in Africa South of the Sahara - import permit, certificate and treatment on arrival; from other countries - imports permissible only by Plant Protection Service and requiring certificate and treatment on arrival.

Unmanufactured cotton from countries other than those in Africa South of the Sahara - inspection and treatment if necessary.

Date palm (*Phoenix dactylifera*)

Vegetative material - imports permissible only by Plant Protection Service and requiring certificate.

Seed - certificate.

Elms (*Ulmus* spp. and *Zelkova* spp.)

Vegetative material and seed from countries where *Ceratocystis ulmi* exists - prohibited; from other countries - import permit and certificate with declaration that the disease does not occur in the plantation of origin and that the trees or parent trees were inspected during growth and found free from all diseases.

Eucalyptus spp.

Vegetative material - prohibited.

Seed - import permit and certificate; also subject to inspection and treatment on arrival.

Forest trees (except eucalyptus and conifers)

Vegetative material - imports only by Plant Protection Service and requiring certificate and quarantine.

Seed - import permit and subject to inspection and treatment on arrival.

Fresh fruit (except citrus and rosaceous fruit)

Fruit from Asia, Pacific Island, Mauritius and Ceylon, and any other country where *Dacus dorsalis* has been found - prohibited ; from other countries - unrestricted.

Ginger (*Zingiber officinale*)

Vegetative material for planting - import permit and certificate with declaration of growing season inspection indicating freedom from tomato spotted wilt virus.

Seed and material for consumption - unrestricted.

Gramineae (millets, sorghums and others not mentioned elsewhere)

Vegetative material - prohibited.

Seed and grain for consumption - certificate and inspection on arrival and treatment if necessary.

Grapevine (*Vitis* spp.) and other ampelidaceous plants

Vegetative material from Japan, China (including Manchuria), and Korea - prohibited ; from African countries South of the Sahara - import permit and certificate with declaration of growing season inspection indicating freedom from Pierce's disease, other viruses and *Erwinia vitivora* ; from other countries not specifically prohibited - same requirements and in addition quarantine.

Seed - import permit and certificate with declaration as above ; treatment on arrival.

Groundnuts (*Arachis* spp.)

Vegetative material - prohibited.

Seed for planting - import permit, and treatment also required if originating from countries where *Puccinia arachidis* occurs.

Seed for consumption - inspection on arrival and treatment if necessary.

Helianthus spp. (including sunflower and Jerusalem artichoke)

Vegetative material - prohibited.

Seed and commercial shipments from countries where virus diseases occur - prohibited.

Seed from other countries - import permit and certificate with declaration that virus diseases are not known to occur in the country of origin and that parent plants were found free from viruses.

Commercial shipments from other countries - unrestricted.

Kola (*Cola* spp.)

Vegetative material - prohibited.

Seed from countries other than those in Africa South of the Sahara - prohibited ; from African countries South of the Sahara - unrestricted.

Living organisms

Living invertebrates capable of causing damage to agriculture and silviculture and cultures of plant parasites - imports permissible only by Plant Protection Service in exceptional cases.

Maize (*Zea* spp.) and other species of Maydeae

Vegetative material, including that used for packing - prohibited.

Seed from Asia - imports only by Plant Protection Service and requiring quarantine.

Seed from countries outside Asia - import permit and certificate with declaration indicating that *Bacterium stewartii* was not found in the field of origin during growing season. Seed treatment before shipment, with description of the treatment also required.

Grain for consumption from Asia - prohibited ; from countries outside Asia - inspection on arrival and treatment if necessary.

Malvaceae (except cotton) and Bombacaceae (*Ceiba* spp. etc.)

Vegetative material from Central and South America - prohibited ; from other countries - import permit and certificate with declaration of growing season inspection. The material must be free from flower buds, flowers and fruit.

Seed - certificate and inspection on arrival and treatment if necessary.

Mango (*Mangifera indica*) and *Anacardium* spp.

Vegetative material from African countries South of the Sahara (except Madagascar) - import permit and certificate with declaration of growing season inspection concerning all diseases ; from other countries - imports only by Plant Protection Service and requiring certificate with declaration on growing season inspection concerning viruses, and requiring quarantine.

Seed - import permit and certificate with declaration that parent trees were found in growing season free from all diseases, especially viruses.

New Zealand hemp (*Phormium tenax*)

Vegetative material - import permit and certificate with declaration of growing season inspection concerning all diseases.

Seed - certificate.

Fiber - unrestricted.

Oil palms (*Elaeis* spp.)

Vegetative material - certificate with declaration of growing season inspection concerning vascular diseases.

Seed - certificate and inspection on arrival and treatment if necessary.

Olives (*Olea* spp.)

Vegetative material from African countries South of the Sahara - import permit and certificate with declaration indicating the country of origin to be free from *Pseudomonas savastanoi* ; from other countries - imports only by Plant Protection Service and requiring certificate with declaration indicating freedom from diseases in the growing season, and requiring quarantine.

Seed - certificate.

Opuntia spp.

Vegetative material, seed, fruit and cut flowers - prohibited.

Ornamental plants, trees and shrubs (except rosaceous plants)

Vegetative material - import permit and certificate with declaration of growing season inspection concerning freedom from all pests and diseases. Inspection also required on arrival.

Passion flowers (*Passiflora* spp.)

Vegetative material - imports only by Plant Protection Service and requiring certificate with declaration indicating freedom from virus diseases in growing season, and requiring quarantine.

Seed - certificate.

Peas and related legumes (*Pisium, Lathyrus, Vicia, Vigna, Dolichos lablab*)

Vegetative material - prohibited.

Seed - import permit and certificate with declaration that *Pseudomonas pisi* and *Corynebacterium flaccumfaciens* are not known in the country of origin, or that these diseases were not found on parent plants or in the field of origin in the growing season.

Seed for consumption - inspection and fumigation if necessary.

Phaseolus spp.

Vegetative material - prohibited.

Seed - certificate with declaration that *Corynebacterium flaccumfaciens* is not known in the place of origin or that parent plants were found in the growing season free from *C. flaccumfaciens*.

Peppers, red (*Capsicum* spp.)

Vegetative material from countries outside Africa South of the Sahara or countries in Africa South of the Sahara where *Phytophthora capsici* occurs - prohibited ; from non-infested countries in Africa South of the Sahara - import permit and certificate with declaration that *P. capsici* does not occur in the country of origin and that the plants were found in the growing season free from all diseases.

Seed from countries where *P. capsici* occurs - prohibited ; from other countries - certificate with declaration that *P. capsici* does not occur in the country of origin.

Commercial shipments - unrestricted.

Pepper (*Piper* spp.)

Vegetative material and seed from African countries South of the Sahara - import permit and certificate ; from other countries - prohibited.

Pineapple (*Ananas comosus*)

Vegetative material from African countries South of the Sahara - certificate ; from other countries - imports only by Plant Protection Service and requiring certificate with declaration on growing season inspection, and requiring quarantine.

Potatoes and related species of *Solanum*

Vegetative material (except tubers) - prohibited.

Seed potatoes - import permit and certificate with declaration indicating freedom from *Phytophthora infestans* and larvae and adults of *Leptinotarsa decemlineata*. Also, additional declaration indicating that through growing season inspection both the plants and the field were free from cyst-forming nematodes (*Heterodera rostochiensis, H. punctata, H. schachtii*), *Synchytrium endobioticum, Spongospora subterranea* and *Corynebacterium sepedonicum*. Tubers must be free from soil.

Seed tubers from regions where the pathogens mentioned above occur - prohibited.

Potatoes for consumption - certificate with declaration that the place of origin is free from the pathogens named above. Tubers must be free from soil and are subject to inspection on arrival.

Pyrethrum (*Chrysanthemum cinerariaefolium* and other species)

Vegetative material from African countries South of the Sahara - import permit and certificate with declaration on growing season inspection concerning all diseases ; from other countries - imports only by Plant Protection Service and requiring certificate, and quarantine.

Seed from African countries South of the Sahara - treatment on arrival ; from other countries - imports only by Plant Protection Service, and requiring certificate and treatment.

Rice (*Oryza* sp..)

Vegetative material - prohibited.

Seed from African countries South of the Sahara - import permit and certificate with declaration that it has been treated with a mercury fungicide and inspection on arrival ; from other countries - imports only by Plant Protection Service, and requiring certificate with a similar declaration concerning seed treatment, and requiring quarantine.

Rice for consumption - inspection on arrival

Rosaceous ornamentals

Vegetative material for multiplication and commercial shipments from Southeast Asia, East Asia and Pacific Islands - prohibited.

Vegetative material for multiplication from other countries - import permit and certificate with declaration on growing season inspection concerning *Erwinia amylovora* and viruses.

Commercial shipments from other countries - certificate.

Seed - certificate.

Rosaceous fruit trees

Vegetative material from Southeast Asia, East Asia and Pacific Islands - prohibited ; from other countries - import permit and certificate with declaration that by growing season inspection the plants were found free from *Erwinia amylovora* and viruses.

Seed - certificate.

Fresh fruit from Southeast Asia, East Asia, Pacific islands and any other country where *Dacus dorsalis* occurs - prohibited ; from other countries - certificate with declaration that *Dacus dorsalis* does not occur in the region of origin, and inspection on arrival and treatment if necessary.

(*to be continued*)

NEWS AND NOTES

INTERNATIONAL AGRICULTURAL AVIATION CENTRE

The International Agricultural Aviation Centre (IAAC), founded in July 1958 under the auspices of the Organization for European Economic Co-operation under the name of the European Agricultural Aviation Centre (EAAC), has now become an independent organization, the operations of which will be financed by the participating countries. The Centre has 12 member countries in Europe but the change of its name indicates that its activities may be extended beyond the European countries in the future.

The Centre will continue to promote scientific research in every branch of agricultural aviation, including the aerial application of pesticides for the control of plant pests and diseases. Some of the problems which are regarded by the Centre as requiring urgent attention include engineering in application equipment, physical qualities of spray liquids, drift control, evaluation methods of biological results, accurate control of droplet-size and safety precautions.

The Centre also convenes international meetings for the exchange of information and organizes working parties of experts for specific problems. Two working parties which have already been established are studying problems relating to the use of helicopters in viticulture and the physical requirements of aerial spray chemicals. *Agricultural Aviation*, a quarterly bulletin published by the Centre, is designed to report on recent developments in this field.

Further information on the Centre may be obtained from International Agricultural Aviation Centre, 1e v.d. Boschstraat 4, The Hague Netherlands.

Stabilimento Tipografico Fausto Failli - Via Tuscolana, 128, Roma

GRASS COVER OF AFRICA

FAO Agricultural Studies No. 49

This important work is actually a summary in map form of the extent of present knowledge of the grass cover of Africa which can be used as a guide not only in the field of range or grassland management, but also in the wider reaches of land use generally. Included with 143 pages of text is a six-color 1 : 10,000,000 map in separate folder of Africa's grass cover as compiled from discussions and correspondence with a great number of specialists in Africa and elsewhere.

Textually, the study deals with ecological relationships of Africa's grass cover and types of vegetation with which such cover is associated. Twenty-three genera used to distinguish the various associations are also discussed, as well as types of the grass cover itself. There are a number of appendixes, including an index of African grass cover types and their geographical distribution.

Publication of this study has resulted from a decision by FAO to map the grass cover of Africa first, and then to use the experience and technique so gained to prepare maps of other parts of the world. It represents a first step forward toward the long-term objective of mapping the grazing resources of the world's underdeveloped countries on some basis of value to those concerned with the improvement of grassland management and the livestock industries dependent on them.

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